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(54) PRINTING PLATES FOR INTAGLIO PRINTING AND METHOD OF PRODUCING THEM

(71) We, DE LA RUE GIORI S.A., a Swiss Body Corporate of 4, rue de la Paix, 1000 Lausanne, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to printing plates for intaglio printing or steel plate printing, and to the methods of producing these plates. More particularly it concerns printing plates of the type comprising depressions capable of receiving ink, and planar surfaces capable of being rendered non-receptive to ink or ink repellent prior to the inking of the plate, and of being maintained in such condition throughout the printing operations.

Intaglio printing processes conventionally involve the application of ink to the whole of the surface of a suitably recessed plate and, subsequently, the removal of all the ink present on the planar surface of the plate. When this operation has been performed by means of wiping devices or bands the printing process takes place and the ink within the recesses is transferred to the paper or other material to be printed.

The plates used in intaglio printing are conventionally ink receptive over the whole of their surfaces which contact the material to be printed. Thus, the application of ink to the planar surfaces serves no useful purpose other than insofar as it is part of a satisfactory method of ensuring that all of the recesses are suitably filled with ink and ink is necessarily wasted.

The production of intaglio printed security documents, such as banknotes for example, usually involves the use of plates having depressions of varying depth. These usually range from a fraction of one thousandth of an inch to about seven or ten thousandths of an inch in depth and, in their entirety, constitute the desired design for the document to be printed therefrom. The plates themselves are produced either directly or indirectly by a skilled engraver, capable of reproducing an original artistic work by engraving it on to a plate or a master plate, in such a way that the printed result will not only be a good reproduction of the original but will also have the artistic elements of shading, variations in tone, etc. which can be reproduced by the careful engraving of lines and depressions of varying depth and pitch. Normally, the engraver produces a master from which plates are produced by well-known transfer processes, electro-forming being one example. The depressions may be of any shape but are most usually fine lines which together reproduce the original artistic work.

This invention primarily relates to the type of plates referred to above but is equally applicable to plates in which the depressions are of equal depths, such as those manufactured by suitably controlled mechanical engraving processes, for example.

The idea of a intaglio printing process without incorporating a wiping device has already been proposed, using plates in which, similar to the known and basic principles of lithographic printing, only the depressions are receptive to ink, while the planar surfaces are capable of being rendered non-receptive to ink by treating with a moistening agent. In the printing process proposed a moistening device is provided which applies a moistening film to the planar surfaces before inking so that when the inking is carried out, only the depressions accept the ink, the planar surfaces being ink repellent. In this way, not only the usual wiping devices are obviated but a saving in ink is also achieved, this saving being of economic importance owing to the proportionately high cost of intaglio printing ink. Up to the present time, no advantageous could be taken of this economical method in

practice, because no adequate process for making this special plate for intaglio printing had been devised.

According to the invention there is provided a method for producing a printing plate having depressions the inside surfaces of which are formed by a first substance, such as copper, capable of accepting ink, and non-ink-printing surfaces formed by a second substance, such as matt chromium, repellent to ink or capable of being rendered repellent to ink by a moistening agent, said plate being for use in intaglio printing process without wiping devices but including a moistening device for the said printing plate, comprising the steps of providing a plate having a surface layer of said first substance and with depressions in said surface layer of said plate, placing in said depressions a filler material non-receptive to said second substance, applying a layer of said second substance on the surface of said plate, and removing said filler from said depressions.

The substance receptive to ink can be any metal capable of accepting and retaining ink prior to its application to the material to be printed, but capable of accepting and/or retaining a moistening agent which is applied to the plate before inking, thereby rendering other areas of the plate repellent to ink. Copper is a particularly useful example for the plate substance but because of its relatively low mechanical strength, in some cases it is preferable to replace solid copper plates by plates which are mechanically stronger, for example, nickel plates provided with a flash coating of copper, of the order of .0001 inch, in the depressions.

The second substance belongs to the group of substances capable of being made ink repellent by dampingy in other words, capable of accepting and retaining moisture applied to the surface of the plate before the plate is inked. Particularly, metals that can be electrochemically or chemically deposited on the planar surfaces of the printing plate, can be employed. A layer of matt chromium is one of such metals especially suitable but this is by no means a limiting example. Workers skilled in the art will be aware that other ink repellent substances can be used such as zinc, anodized aluminium or nickel.

The filler must be totally resistant to the second substance and firmly lodged in the depressions throughout the plating operation by which the second substance is applied.

Preferably, the filler is in the form of a paste, of such consistency that it can be readily applied to the depressions, filling all of them completely, even those which may have a minimum depth of less than .001 inch. There are no criteria for the composition of the filler provided it has the chemical and mechanical properties as outlined above and, also, provided that it is capable of being completely removed from the depressions after the plating treatment without having any undesirable effect on the ink receptive metal underneath. It has been found that fillers composed of finely divided inorganic compounds and certain thermoplastic compounds with a high melting point, carnauba wax, for example, are particularly suitable. Preferably the fillers should include pigments or staining additives, so that the presence of the filler can be readily seen. Also, by preference, the particles of inorganic substance should be coated with wax or any other suitable thermoplastic substance.

The filler composition is preferably capable of being fired in the depressions by the application of sufficient heat to the plate in order to cause the particles to sinter. Suitable filler compounds are described below.

The invention will be more readily understood by referring to the accompanying drawings given by way of example.

Figures 1 to 4 diagrammatically show the principal steps in a first example of carrying out the method of the invention.

Figures 1, 2, 3a and 4a diagrammatically show the principal steps in a second example.

In all of the Figures, the entire printing plate is referred to as "1".

Figure 1 shows a nickel printing plate 2 in which depressions 3 are made of a varying depth and together composing the designs of a given banknote, reproduced from the artist's original engraving by an electro-forming process. The entire surface of the plate is flash coated with copper 4, to a thickness of the order of .00008 inch for example.

This plate was then curved and mounted on a rotatable rig conforming to the configuration of a plate cylinder of a printing machine on which the plate is to be used.

A paste having for example a composition as that described later in Example II, was applied over the entire surface of the plate, by means of coating rollers. Due care was taken to ensure that the paste completely filled up each of the engraved depressions.

The paste adhering to the planar areas of the printing plate was then removed by a cleaning roller with a polyvinyl - chloride surface, a doctor blade acting on the roller surface to remove any paste adhering and cunning in a trough of water to clean it and moisten its surface before application to the plate. The roller pressure on the plate surface was carefully adjusted to ensure that although the paste was removed from the planar surfaces none of the paste was removed from the depressions, as shown in Figure 2. The pigments or staining additives to the paste, owing to colour contrast, facilitated the visual inspection of the printing plate to ensure that the planar surfaces were absolutely clean.

The temperature of the plate was then raised sufficiently to partially melt the inorganic constituents in the filler, alumina particles, for example, causing them to sinter. During the heating, any remaining solvent in the filler paste was evaporated.

The plate was then allowed to cool and its planar surfaces polished with a rather coarse abrasive polishing powder to remove any remaining traces of unwanted substances, such as carnauba wax, remaining on the planar areas. The plate was then removed from its jig, washed and dried.

The plate was then placed in a conventional self-adjusting chromium plating bath and plated over its planar areas to produce a chromium layer 6, to a thickness of about 5 microns (Figure 3). It should be noted that the layer of chromium should not be thicker than .001" and, preferably only a few microns. After plating, the printing plate was replaced on the jig and subjected to the action of trichloro - ethylene vapour to dissolve the filler from the depressions. Figure 4 shows the planar surfaces covered by a layer of chromium 6, preferably matt, and with the filler 5 removed from the depressions 3 so that the layer of copper 4 is exposed.

In the second example, the steps previously described were repeated with the exception that the thin copper flash 4 on the planar surfaces of the nickel plate was removed before it was chromium plated, as shown in Figures 3a and 4a.

The advantage found in the second method lies in the elimination of problems which might arise from any irregularities in the thickness of the copper flash. The complete removal of the copper flash from the planar surfaces provides a clean nickel surface for plating with chromium.

In order to increase the acceptance properties to moistening in the chromium layer, it has been found useful to heat the plate, before the removal of the filler from the depressions, in a watery electrolytic solution, preferably at a temperature of 50°C to 90°C, containing ink repellent ions capable of penetrating the porous chromium, particularly by capillary action. In this way, the chromium layer itself ink repelling will be additionally impregnated with another ink repellent substance, most of it chemically bound into the chromium.

The electrolytes which are used preferably have similar compositions as those agents employed later on during the printing process for moistening the planar surfaces of the plate, such agents being known in lithographic printing. A suitable electrolyte solution can be alkaline, containing phosphates for example.

The following are examples of suitable fillers and methods of making them:

EXAMPLE I

Barium Sulphate	60 gms.
Carnauba wax	20 gms.
Blue oil stain	1 drop
Turpentine	20 gms.
Chlorinated diphenylene or polyphenylene mixture, sold for example under the Trade Mark AROCHLOR	20 gms.

Note: ratio pigment (barium sulphate) to wax is 3:1

EXAMPLE II

Carbon black	15 gms.
Alumina	15 gms.
Carnauba wax	30 gms.
Turpentine	20 ccs
Chlorinated diphenylene mixture	20 gms.

Note: ratio of pigment (carbon black and alumina) to wax was 1:1.

EXAMPLE III

A filler comprising essentially of barium sulphate and mechanically ground carnauba wax was prepared by dissolving the wax in trichloro - ethylene and coating the barium sulphate particles with the solution. The major portion of the solvent was then removed by heating slowly.

EXAMPLE IV

A filler was produced by dissolving carnauba wax in trichloro - ethylene and heating the solution slowly to evaporate the solvent with the gradual and simultaneous addition of a mixture of chlorinated diphenylenes dissolved in trichloro - ethylene. The addition of the said mixture caused the carnauba wax to precipitate in finely divided particles. Alumina was then mixed in during the precipitation process, and the composition heated to evaporate the solvent slowly, thereby producing a paste.

Instead of carnauba wax, bees wax or a mixture of carnauba wax and bees wax can be used.

As a result, planar surfaces of the printing plate now have excellent ink repellent properties which are retained for a considerable time during the printing process. It should be noted that the trichloro - ethylene which is applied later in order to remove the filler will not effect the binder as trichloro - ethylene dissolves by physical action only.

Alternatively the plate can also be impreg-

Preferably the ratio of wax to the inorganic component in the filler is within the range of ratios of 1:1 and 1:4. Trichloro - ethylene vapour is preferably used for removing the hardened filler from the depressions in the printing plate.

EXAMPLE V

A filler is made from polyvinyl chloride powder dispersed in a polyurethane lacquer and coloured with an oil-soluble dye. This filler can be removed from the depressions, after the surface of the plate has been coated with the second substance, with a mixture of cyclohexanone and methyl ethyl ketone.

EXAMPLE VI

A filler is made from acrylic powder dispersed in a polyurethane lacquer and coloured with an oil-soluble dye. This filler can be removed with trichloro - ethylene, after the surface of the plate has been coated with the second substance.

The method described for producing the plate and for preparing the filler are, of course, only given by way of example and variants can be used. For example, it is possible to start from a printing plate made from a substance that will accept ink, such as copper alloy, brass or steel. On the other hand, the substance from which the carrier plate is made and which is to be coated with the first substance can be another substance such as, for example, brass or steel. The engraved lines or depressions for intaglio printing can have depths between .0005 inch and .01 inch, but preferably from .001 up to .004 inch.

In the case of accurate printing plate production, it is preferable that the stages of the treatment for the plates should be carried out when the plate is in the curved position corresponding to the shape of the cylinder to which it is to be attached.

The use of the word "planar" to define the non-imprinting surfaces does not of course imply that these surfaces are flat, on the contrary, these surfaces can have a conventional cylindrical shape.

WHAT WE CLAIM IS:—

1. A method for producing a printing plate having depressions the inside surfaces of which are formed by a first substance, such as copper, capable of accepting ink, and non-imprinting surfaces formed by a second substance, such as matt chromium, repellent to ink or capable of being rendered repellent to ink by a moistening agent, said plate being for use in intaglio printing process without wiping devices but including a moistening device for the said printing plate, comprising the steps of providing a plate having a surface layer of said first substance and with depressions in said surface layer of said plate, placing in said depressions a filler material non-receptive to said second substance, applying a layer of said second substance on the surface of said plate, and removing said filler from said depressions.

2. A method according to claim 1, wherein said filler material is coated on the surface of said plate, the non-imprinting surface of said plate is wiped clean of said filler material, and the filler material in said depressions is allowed or caused to set before applying said second material.

3. Method according to claim 2, wherein said filler material is thermo-setting and comprises a thermo-plastic constituent such as carnauba wax, beeswax, or a mixture of such thermo plastic constituents, an inorganic component such as barium sulphate or alumina, and a solvent such as turpentine or tri-chloro - ethylene.

4. Method according to claim 3, wherein said filler material comprises additional thermo plastic substances such as chlorinated di - phenylenes and/or polyphenylenes.

5. Method according to claim 2, 3 or 4, wherein said filler material comprises a colouring agent such as carbon black or blue oil stain.

6. Method according to claim 3, 4 or 5 when appendant to claim 3, wherein the ratio by weight of said inorganic substance to said wax component is within the range 1:1 to 1:4.

7. Method according to claim 3, 4, 5 or 6, wherein said filler is removed from said depressions by dissolving same in trichloro - ethylene.

8. Method according to claim 2, wherein said filler material comprises an acrylic powder dispersed in a polyurethane lacquer and coloured with an oil-soluble dye.

9. Method according to claim 8, wherein said filler material is removed from said depressions by dissolving same in trichloro - ethylene.

10. Method according to claim 2, wherein said filler material comprises powdered polyvinylchloride dispersed in a polyurethane lacquer and coloured by an oil-soluble dye, and wherein said filler is removed from said depression by dissolving in a mixture of cyclohexanone and methyl ethyl ketone.

11. Method according to any preceding claim, wherein before or after said plate is coated with said second substance, said plate is treated by a dilute electrolytic solution preferably within the temperature range 50°C to 90°C, said electrolytic solution containing ink-repellent ions which penetrate in and impregnate said second material.

12. Method according to claim 11, wherein said electrolytic solution contains a binder such as gelatine or gum arabic.

13. Method according to claim 11 or 12, wherein said electrolytic solution contains phosphates to render it alkaline.

14. Method according to claim 11, wherein said electrolytic solution has substantially the same composition as that of dampling agents ebk in printing to moisten said plate.

15. A method according to any preceding claim, comprising the steps of providing a plate of nickel having the desired depressions, coating a copper layer on said plate, applying said layer of filler material non-receptive to chromium on the surface of said plate by means of rollers, wiping said filler material off from the non-imprinting surface of said plate, allowing or causing said filler to harden in said depressions, and polishing said non-imprinting surface with an abrasive or polishing powder before applying a layer of chromium to the surface of said plate.

16. Method according to claim 15, wherein said layer of copper is removed from the non-imprinting surfaces of said plate before said layer of chromium is applied thereto.

17. Method according to claim 15 or 16, wherein the thickness of said copper layer is of the order of 0.0001 inch and the thickness of said chromium layer is less than 0.001 inch.

18. Method according to any preceding claim wherein said printing plate is handled throughout the various steps of said method in a curved jig corresponding to the shape of a cylinder to which it is attached.

19. A method for producing a printing plate substantially as hereinbefore described and shown in the accompanying drawings.

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Agent for the Applicants.

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1283239 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig. 1

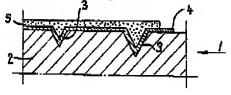

Fig. 2

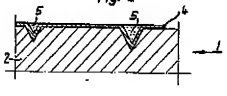

Fig. 3

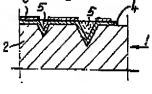

Fig. 3a

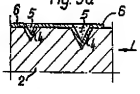

Fig. 4

Fig. 4a